

# **AQUACULTURE POTENTIALS AND INVESTMENT OPPORTUNITY IN SHRIMPS AND PRAWNS FARMING IN NIGERIA.**

**BY**

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## **ABSTRACT.**

*Some aspects of the aquaculture potentials and investment opportunity in shrimps and Prawn farming in Nigeria were overviewed. This paper presents the breeding pattern, spawner availability, culture water-type and properties, feeds and feeding regimes and other factors needed in practical shrimps and prawns culture. The culture systems, water management, larval management, stocking density, feeding strategies and diseases were fully discussed. The investment opportunity available as government plans to boost production of these resources from both artisanal and aquaculture sector was documented. Management strategies needed in practical practices of shrimps and prawns culture were enlisted. Effected efforts from the government were listed in this paper.*

**Key words: Aquaculture, feeding, shrimps, prawns, Investment opportunity, Management strategies.**

## **INTRODUCTION**

Nigeria is blessed with area of 923, 858km<sup>2</sup> with a rich coastline of 853km bordering the Atlantic ocean in the Gulf of Guinea, a maritime area of 46, 300km<sup>2</sup> between 0-200m depth and exclusive economic zone of 200m covering an area of 210,900km<sup>2</sup> (Ugwumba, 1996; Tobor, 1985). In addition, the country is blessed with many inland water bodies whose total area is estimated as 125,470,82km<sup>2</sup> (12,547,082 ha, Tobor, 1992).

Shrimps have 70% protein dry matter (Mba, 1980) which is a good source of animal protein in man's diet. Shrimps consumers have been reported to enjoy nutrition food of this animal protein accompanying with good health (Sogbesan, 1998a). The increasing human population, relatively cheap cost shrimps and desire to obtain a nutritionally balanced level of protein intake remain major causes of demand outstripping supply for shrimps and prawns in Nigeria. Nigeria with a projected population of 128 million and 12.5kg per cap put consumption requires 1.6 million of both shell and fin fish in other to meet up the protein need of the populace this year (2004 FDF, 2003). The implication of this high population and fish demand is that more people will continue to have less proteinous food to feed on and this will lead to malnutrition pestilence, lack of resistance to diseases and reduction in labour output (Sogbesan, 2004). Adegbola (1999) also reported that about 40% of Nigerian children are undernourished, which manifested in low weight for age height and various degrees of stunning and higher susceptibility to disease infection. The immediate solution to this problem is found in increasing shell fish production by aquaculture sector, shrimp culture if well managed is self sustainable, income providing venture and gainful employment. This paper focuses on the aquaculture potentials and investment opportunity in shrimps and prawn farming in Nigerian especially on small-scale sector as we think of alleviating poverty through fishery resources

## **CURRENT STATUS OF SHRIMP AND PRAWN RESOURCES IN NIGERIA.**

Nigeria is blessed with rich diversity of both fin and shell fish resources. The shell fish resources are from both coastal and inshore industrial sector and freshwater. From the coastal region; shell fish like white shrimp (*Nematopaleamon hastatus*), brackish water prawn

(*Macrobrachium machrobranchium*), river prawn (*M. vollehavenii*), Pink shrimps (*Penaeus notialis*), bivalve, crabs and Periwinkles with total potential yield of 48,000 mt have been exploited. Although white shrimps constitute about 50% of the estuarine catches (FDF, 2003). Shrimp ground covers of about 2,500km<sup>2</sup> are located off Badagry to Lagos; Lekki lagoon system and mouths of rivers in the Niger Delta region. About 2,868mt and 15,249mt of the shell fish resources were exploited from the inshore industrial sector in 1988 and 1999 respectively which is about 81.17% increase in the production. In 1999 government realises N22,440 while N22,090,000.00 was realized in 2001 from inshore shrimping licenses which is about 98,340% investment increase and this accounted for 43.35% of revenue generated by Federal Government from fish production in year 2001 (FDF, 2003). It was fully documented that in year 2000 Nigeria exported shrimp worth US \$46.495 million (N5.58 billion), which is an improvement from what has been happening in former years. This means there is a future for shrimps and prawn investment in Nigeria.

Shrimp farming is gaining recognition and support from government especially in developed countries. As at 2003, Thai shrimp farming industry has grown to about 310,000 tonnes/year about 250, 000 tonnes) year 2002 (Fish farmer, 2004). This travel of increase is also reported in Vaetnam 158,000 tonnes/year, India – 127,000 tonnes and Brazil with 40,000 tonnes/year. Despite this, export market is also increasing and this is dominated by U.S. which consumes about 350,000 tonnes/year whereas both Europe and Japan imports 300,000 and 250, 000 of shrimps/year. The demand from within and outside the country is increasing geometrically and from all indication, artisanal shrimping has really been contributing immensely to shrimp production but the only hope of bridging the deficient gap is to boost shrimp production from aquaculture aspect, this has been reported in Taiwan and China (Fish farmer, 2004).

## **CULTURE AND MANAGEMENT METHODOLOGY**

### **Shrimp and Prawn Culture**

From aquaculture point of view tiger shrimp is best suited for culture in isolation from production and economics aspect. This shrimp is known to have a better survival rate when grown four juvenile stages to marketable size in different culture systems. Cannibalism is a great norm in post-larve when stocked without nursery rearing; the survival rate has been reported to be comparatively low (Ravichard or et. al. 1982, Rajyalakshim, 1982, Agunacop 1984). The often occurrence of cannibalism cases in influenced by dense stocked density (Abdusshmdhy Thampy. 1994).

Crustacean culture methodology.

#### **a. Collection of the breeding stock**

Young and mature shrimps and prawns suitable for culturing and breeding from the wild with trap, line and hand-net. Baits like coconut, earthworm, fish, prawn etc can be used. The mesh size of the net is determined by in size of the expected catch. In most cases, traps, nets are get in the afternoon and before overnight, at night, prawns tend to over into shallow water to feed. When the water is clear a force light can reflect their pinkish or whitish ash colour or by reflection of light in their pinkish eye and specimens momentarily stupified by the bright light can be caught with hand-net drawn from tail to head.

#### **b. Transportation**

For safety purpose live specimens of this crustacean can be transported in any of the following for breeding purpose.

- 1) Large tanks with aeration or continuous water circulation
- 2) Plastic bag with oxygen, provide that the sharp of rostrum is cut off to prevent puncturing of the bag. This is appropriate for long Journey transport.
- 3) Shallow open fish container. Water level must be deep enough to cover the specimens. With this method prawns and shrimps can be transported for 3-8 hours.

- 4) Bamboo baskets packed between layers of moistened moss or soft aquatic plants. Prawns and shrimps will survive for several hours in this method provided water is sprinkled into the basket at frequent intervals this remaining the traditional means of transporting shrimps and prawns especially by the marketers of live specimens.

#### **c. Conditions for mating, spawning and hatching**

Spawning in isolation becomes necessary if there are no berried females in the natural habitat. Mature healthy males are kept separately, one in a tank, but several mature females can be kept in a large tank and constant screening off of newly moulted ripe females, must be done from the rest females to prevent it from being attacked while her new shell is still soft. Two or 3 hours after moulting, when the new shell is fairly hardened, she is introduced with one of the male tanks.

#### **d. Mating**

Mating takes place within a few hours, followed by egg-laying within 6-20 hours. Laying of one batch of egg is complete within 20 minutes for commercial purpose, group spawning is ideal. A tank of about 1m x 2m x 0.4m can hold about 10 specimens and a trough of 1.5m x 3m x 0.4m can hold about 24 specimens. At a ratio of one male to 4-5 females. When newly moulted sexually-ripped females are introduced into the male tanks, they are promptly attended to by the male and both mating and egg-laying take place without trouble (Ling, 1969.).

Efficient aerators are highly essential in all spawning tanks and troughs. Few days after egg-laying, the berried females should be transferred into hatching tanks and kept separately in a tank individually. The water level of the tank should be about 50-60 litres. During incubation period the water should be kept clean and well aerated to boost survival of the hatchlings.

#### **e. Hatching.**

Changing of the colour of the eggs from bright orange to light grey denotes the hatching of the egg.

### **REARING OF YOUNG PRAWN AND SHRIMPS**

Prawns of about 5cm, weight 2.0g and barely 2 months old are suitable for culturing. These prawns and shrimps thrive well in well oxygenated water within the temperature range of 22-32°C (Ling, 1969). They can be raised in pond, partitioned canals and irrigated padi-fields. Fish-ponds or any pool of not less than 400m<sup>2</sup> and over 0.5m in depth, can be used for culturing prawn and shrimps though ponds over 1,000m<sup>2</sup> and 1-1.5m depth are more suitable and economical to operate for commercial purpose.

### **POND PREPARATION.**

**A. Land acquisition:** It is imperative for a farmer to locate a good site for his farming business. Land availability is a key factor for planning an aquaculture venture. A land with no profitable competing value is better for pond construction especially, flooded or swampy piece of land that cannot be used for any other alternative profitable use.

The vegetation type is important. The landed property must not be filled with big trees because of the cost of removing them. The best soil type is loamy soil. Soil with a lot of rock is not good because of the cost of blasting the soil. Clayey soil tends to be acidic and the cost of liming to control the acidic content is high. Soil chemistry analysis should be carried out especially, in order to ascertain the presence and concentration of some heavy metals that could be toxic to the fish (Okoye, 1996).

**B. Clearing:** All obstacles on the sites are removed with bulldozer or tractor. Where any of these machineries is not available manual work can be adopted.

**C. Pegging / Mapping:** This is done after site clearing. This is use to size the pond. Pegs are used to determine the position of the slope, main dyke, pond depth (bottom), feeder canals and drainage canals.

**D. Excavation and Dyke building:** A bulldozer is needed for this operation. Scraping of the top soil layer (10-15cm) is done. The top soil is kept somewhere for the purpose of lining the pond, because it is rich in nutrient. A depth of 1.0m (shallow) or 1.5 m (deepest) pond is recommended for commercial purpose.

**E. Water inlets and outlets / drainage:** Water inlets are built at the highest part of the pond to ensure easy filling and aeration while outlets are built at the lower part of the pond. PVC, Pipes, Plastic, Bamboo strokes e.t.c could be used as inlet while outlets can be made with concrete monk and water to be released is monitored.

**F. Liming:** This operation is carried out both in fresh and old pond before stocking.

Liming is done in other to check the acidity of the soil, reduced turbidity of the water, enhances primary productivity of the pond, improve the availability of soil nutrient and relieve carbonic ions that positively influence photosynthesis. Adeniji (1996) and Okoye (1996) highlighted the types and quantity of lime needed in pond fro aquaculture purpose.

#### **POND MANAGEMENT BEFORE STOCKNG.**

Immediately a pond is excavated, water will be added to about 0.2 -8.5 m levels and check for retentions, before liming could take place. This is important because if the soil has low water retaining capacity, there is high possibility of leaching of both the water and nutrients, especially in earthen pond.

Flooding from inlet system is screened filtered to check the size of the Fauna and Flora that comes in. The water must be from a good source because of pathogenic microbes that might constitute nuisance and have side effect on the productivity of the pond.

#### **MANURE APPLICATION**

Animal manure such as cow dung, mixed with lime is to be done monthly to promote growth of natural food. About 200kg of cow dung mixed with 10kg of lime will be sufficient for each ha of pond of medium fertility, even month. Fertilizations of pond is directly done through feecal outpourings into the pond water. This does not require extract cost of fertilizer.

#### **STOCKING RATE**

Stocking rate of prawn and shrimp, depend on the readiness of the soil and conditions of water. Table 1 shows pond conditions and stocking rate for prawns and shrimps. These can be adopted for commercial purpose.

#### **FOOD AND FEEDING.**

Small slices of waste fish, molluscs, earthworms, offal's of animals and fish, insects, silkworm pupae, broken rice e.t.c. are all suitable as food for prawn and shrimp. A combination of 75% animal proteins and 25% plant proteins is most suitable for better yield. At this young stage the shrimps and prawns are as well fed 20-25% crude protein. Conventional feeds in addition to the unconventional ones. Adequate fertilization of the pond has been presented to constitute positively to feeding in prawns and shrimps.

##### **Feeding rate:**

The ruling factors of feeding rates are size and number of prawns in the pond, water quality ad nature of feed. Initial feeding rate when adding feed is used in a pond stocked at 5/m<sup>2</sup>

should be 6.25kg/h/day, which can build up to about 37.5kg/ha/day. For example average daily consumption of a pond producing 2500kg/ha/year should be 14-21kg/ha/day.

#### **Frequency of feeding.**

In order to avoid pollution of the habitat the feed is supplied to the larvae in instalmentally daily. In the first 5 days feed supply are 3 times day, 4 times during 5-15 days after which feed is supplied 5 times with 4 meals at the day time and one at night.

The amount of feed given per day is equivalent to 30% of the body of larvae. To ensure that every larval feeds the feed should be added to the medium slowly to observe each larvae picking the feed supplied. There should also be in between meal in addition to feed at this stage. Compounded feed of 35% C.P. can be introduced to three days old larvae which should be supplied at 2 hourly intervals of 4-5 times during the day while at the last feeding natural food should be supplied in a high density.

#### **PRAWN MANAGEMENT AND CARE.**

1. Water inlet should be screened carefully to prevent the entry of young stages and eggs of predatory fish, toad and other aquatic predators. It helps to retain prawns in the pond.
2. Prompt inspection of monks and repair of linkages.
3. Ipomoea aquatics should be grown in the pond to provide shade and shelter for prawns and shrimps.

#### **Growth rate key for monitoring management of cultured prawns.**

Growth rate is rapid in pond cultured young prawns and shrimps with good water management and ample food to have the following growth rate.

The growth rate of young males and female is about the same. After reaching a length of about 18.0cm and weight of 60.0g, the growth rate of females decreases, and there is a little growth beyond about 22.0cm in length and 120.0g in weight. The males keep on growing to about 200.0g.

**Shrimp sampling:** Shrimp sampling can be carried out weekly or biweekly to determine your fish growth by the use of cast net. Take some fish samples and weigh to compare the new weight with the old weights. A progressive increase in body weight is a sign of good feeding and good health. Reduction of growth must be a concern to farmer by checking all the growth and the water quality precautions earlier mentioned in this test.

**Shrimps Harvest/Sales:** At the end of the culturing month, the water can be drained in order to effect total cropping of the stocked fishes, renovation of pond inside, flooding and restocking (Falayi, et, al; 2003). At harvest, shrimps are sorted into sizes because different shrimps commands different price. The prawn is much cheaper than shrimps. Shrimps are measured with baskets in the market or sold in kilogramme at the pond site. Where the sales of shrimps are not possible at site, harvested shrimps should be washed and stored in refrigerator or processed to avoid the quality deterioration (Eyo, 1996).

#### **RESULTS AND DISCUSSION**

Tables 3 and 4 reveals the capital input materials on the shrimps pond and the succeeding year output from fish pond.

At the end of the whole exercise for 5 year period a net profit of about 9 million naira is recorded in the integrated chicken cum fish farming system. No inorganic fertilizer or fish feed is required and two major protein food eggs and meat are produced at once from the farming system (Hopkins, 1982, Ita, et, al/ 1986).

## CONSTRAINTS TO SHRIMP AND PRAWN CULTURE IN NIGERIA

The major constraints to shrimp and prawn culture in Nigeria are highlighted below.

- i) **Inadequate Crustacean seeds production:** Seeds such as larvae, juvenile and young developmental stages are essential in Crustacean production and their production is inadequate even to minimal value. Thus most interested farmers and stakeholders are forced to go for collection of seeds from the wild, which is highly unreliable and seasonal. Consequently enough seeds may not be collected, hence negating both stocking and production.
- ii) **Inadequate Crustacean feeds.** In feeding management of Crustacean, feeding is sequential and more technical than what it entails in fish culture although prawns perform better in well fertilized pond substituted with non-conventional feeds (Tacon, 1996).
- iii) **Water Management Problem:** The problem of brackish water culture needs to be addressed and dully researched into as this has been a cross line encountered by most culturist. A challenge opens to National Institute for Freshwater Fisheries Research (NIFFR), Nigeria Oceanography and Marine Research (NIOMR) and African Research Aquaculture Center (ARAC). These institutes remain the heartbeat of the country's aquaculture development as regards to prawns and shrimps culture.
- iv) **Inadequate man power.** Crustacean farming demands competency and few or none of the facilities needed for such competent training are available in the country. Very few of fish training centers give room to training farmers on shrimp and prawn culture. It is no gain saying that up till now Nigerian shrimp and prawn culture still has unqualified experts who through their incompetence introduce innocent entrepreneurs into unprofitable ventures which are often abandoned by the investors. Such practice further discourages future investors and stakeholders (Ugwumba, 1996).
- v) Limited technology
- vi) High cost of pond construction
- vii) Poor extension service
- viii) Poaching

## STRATEGIES TO HARNESS SHRIMP AND PRAWN PRODUCTION IN NIGERIA

1. Training of fishery officers, interested farmers and other stakeholders.
2. Adequate farm management.
3. Boosting shrimp and prawn seed production.
4. Research (both scientific and Developmental).
5. Easy access to credit facilities.
6. Adequate extension service.
7. Provision of security for the farm to curtail poachers.

## INVESTMENT OPPORTUNITY IN SHRIMP FARMING

Shrimp farming is another form of aquaculture that is gaining popularity and attracting the attention of the international investment agencies, being a high foreign-exchange earner. USAID is prepared as part of the USA OAGDA initiative to assist any interested Nigerian investors to start Commercial shrimp farming in the country and FDF is well prepared as a true link.

## WHAT THE COUNTRY GAINS FROM SHRIMP FARMING

Revenue generated from the fisheries sub-sector presently remains the Federal Government's highest revenue generating sub-sector in the agricultural sector. With government

efforts, there is appreciable increase particularly in shrimp landed by the industrial fisheries operators from 2,376 mt in 1985 to 15,249mt in 1999.

Foreign exchange earnings from shrimps exportation has also increase from \$12,966, 526 in 1992 to \$46,485,491.05 in 2000 (FDF, 2003).

## CONCLUSION

Aquaculture potential and investment opportunity of both shrimp and prawns in Nigeria is mostly unexploited. It stands as the major key to bridging the gap between shrimp demand and supply in future. Shrimps and Prawn farming is revealed in this proposal as viable in that the outputs surpasses the inputs in material and considerable net profit was realized. In the quest for more sources of protein supplement to livestock, Shrimps and Prawn integration farm establishment and management is proposed in this paper based on available information and technologies on the symbiotic relationship between animal waste (Manure) and shrimp. This system is recommended for big time farmers, NGO's, government agencies, retired civil and military men and women and the young graduates roaming about for white-collar jobs.

The realization of the potentials for aquaculture must take into consideration the major constraints currently facing this sector and how to alleviate it.

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**Table 1. Pond condition and stocking rate of prawn and Shrimp**

Pond conditions	Stocking rate (Prawns/ha)
Rich	15,000
Medium	10,000
Poor	6,000

**Table 2 Growth rate keys for prawns management**

Tip in ponds (month)	AVERAGE LENGTH (CM)		
	Tip of rostrum to tip of telson	Tip of antennal scale to tip of telson	Average weight (g).
0	5.5	5.0	2.0
1	7.6	6.5	4.5
2	11.0	9.5	10.0
3	14.0	12.5	25.0
4	18.0	16.5	60.0
5	21.0	19.5	100.0
6	22.5	20.5	125.0

**Sources: (Ling, 1969).**

**Table 3: Inputs for Pond construction/Accessories for 5 years**

Items	Fixed asset.				
	Cost/yr (N)				
	Year 1	Year 2	Year 3	Year 4	Year 5
Land acquisition/clearing	4,000	-	-	-	-
Excavation (medium size)	35,000	5,000	5,000	5,000	5,000
Inlet and monk	15,000	-	-	-	-
Fencing and gate	20,000	-	-	-	-
1 dug out canoe and Paddle	10,000	2,000	2,000	2,000	2,000
Seine net	10,000	3,750	3,750	3,750	3,750
<b>Sub-total</b>	<b>94,000</b>	<b>10,750</b>	<b>10,750</b>	<b>10,750</b>	<b>10,750</b>
Variable Cost.					
Seed: Prawn 20,000@ 5.00 per seed	100,000	100,000	100,000	100,000	100,000
Shrimp 20,000 @ 5.00 per seed	100,000	100,000	100,000	100,000	100,000
Compounded Feed	40,000	20,000	20,000	20,000	20,000
Fertilizer (Cow or poultry dump) 2.5 tons/ha/yr	5,000	2,500	2,500	2,500	2,500
Lime (120kg/ha/yr)	3,000	-	-	-	-
Farming Manager	120,000	120,000	120,000	120,000	120,000
Security man	90,000	90,000	90,000	90,000	90,000
Contingency 5% of capital on recurrent	27,400	21,655	21,655	21,655	21,655
<b>Sub-total</b>	<b>545,400</b>	<b>454,125</b>	<b>454,125</b>	<b>454,125</b>	<b>454,125</b>
<b>GRAND TOTAL</b>	<b>669,400</b>	<b>455, 875</b>	<b>455, 875</b>	<b>455, 875</b>	<b>455, 875</b>

**Table 4: Output on Prawn and shrimp farm succeeding 5 yrs.**

Items	Amount N-/yr				
<b>Prawn at 5% less No stocked (2,385kg , at N 170)</b>	403,750	403,750	403,750	403,750	403,750
<b>Shrimp at 5% less No. Stocked (2,090kg at N 150)</b>	313,500	313,500	313,500	313,500	313,500
<b>Total</b>	<b>717,250</b>	<b>717,250</b>	<b>717,250</b>	<b>717,250</b>	<b>717,250</b>